

**2014 Knotweed Treatment  
In the Cedar River Municipal Watershed**

**Annual Report  
Seattle Public Utilities and Neighborhoods Committee  
Seattle City Council**



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## BACKGROUND

In August, 2010, Seattle City Council, recognizing both the extreme ecological threat posed by the highly invasive species Bohemian knotweed (*Polygonum x bohemica*) and the limited options for treatment, passed an ordinance amending the Cedar River Municipal Watershed Secondary Use Policy Number 6-13 to allow limited application of the herbicide Imazapyr to treat knotweed within the municipal watershed. This ordinance was effective through December 31, 2012.

In early 2010, preliminary data had suggested that three consecutive years of herbicide treatment might be sufficient to kill large patches of knotweed. Subsequent data, however, has indicated that it usually takes eight or more years of annual treatments to achieve greater than 98% mortality on large patches. Consequently, in May of 2013, Seattle Public Utilities (SPU) requested that the Seattle City Council pass a follow-up ordinance to allow continued treatment of knotweed with Imazapyr for an additional three years (2013 – 2015). Ordinance Number 124191 (Council Bill Number 117765) was passed on May 28, 2013. It was virtually identical to the one passed in 2010, limiting herbicide treatment to only Imazapyr used on knotweed, with water quality testing after each treatment, ongoing monitoring, and annual reports to City Council.

In 2013 SPU chose to request only three additional years in order to allow sufficient oversight and feedback from City Council on the knotweed program. However, we informed City Council that because some patches of knotweed were more recently discovered and will have received insufficient treatments through 2015, SPU will need to seek another follow-up ordinance in 2016.

Cumulative total cost to treat 18 acres of knotweed with herbicide from 2010 through 2014 was approximately \$5,400 per acre. This compares with a cost of approximately \$44,000 per acre to treat small scattered patches of knotweed by covering with geotextile fabric, a treatment we tried experimentally on a total of 4.5 acres from 2004 to 2012. Covering was only marginally successful on very small patches. The larger patches were still alive after more than eight years of continual covering. Fabric along active roads was replaced and will be left indefinitely. Isolated patches that were away from active roads and formerly covered were spot-treated with herbicide. Area treated and amount of herbicide used on these patches was negligible. Total annual cost to treat the knotweed with herbicide has decreased from a high of about \$32,000 in 2011 to a low of about \$9,000 in 2014.

The Major Watersheds Invasive Species Management Plan is available on the City of Seattle Habitat Conservation Plan website:

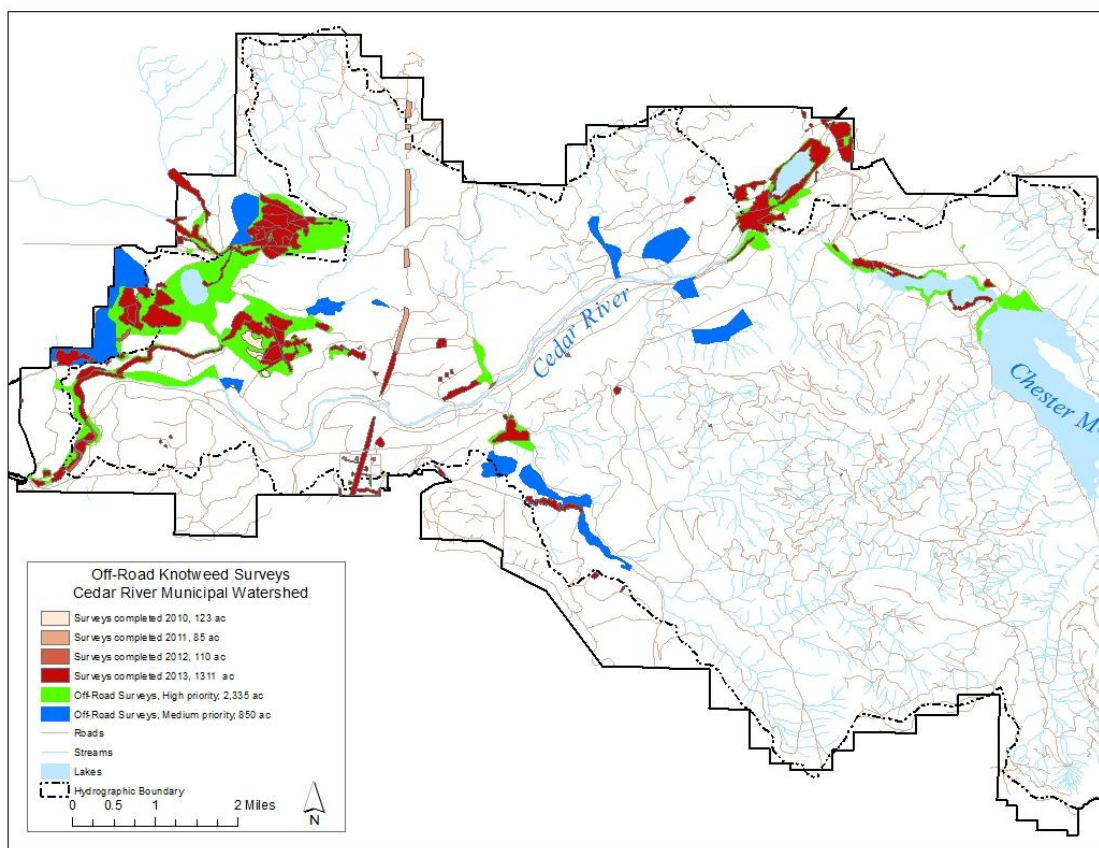
[http://www.seattle.gov/util/EnvironmentConservation/OurWatersheds/Habitat\\_Conservation\\_Plan/ManagingtheWatershed/ProtectWatershedHabitats/ProtectionEfforts/index.htm#invasiveSpecies](http://www.seattle.gov/util/EnvironmentConservation/OurWatersheds/Habitat_Conservation_Plan/ManagingtheWatershed/ProtectWatershedHabitats/ProtectionEfforts/index.htm#invasiveSpecies) .

Previous knotweed reports are available in the Project Plans and Reports section on:

[http://www.seattle.gov/util/EnvironmentConservation/OurWatersheds/Habitat\\_Conservation\\_Plan/ManagingtheWatershed/StreamRiparianHabitatRestoration/Metrics/index.htm](http://www.seattle.gov/util/EnvironmentConservation/OurWatersheds/Habitat_Conservation_Plan/ManagingtheWatershed/StreamRiparianHabitatRestoration/Metrics/index.htm) .

## SURVEYS

In 2013 we identified off-road areas that could potentially contain knotweed, based on the location of known knotweed patches, streams and water bodies, and deciduous forest canopy. We classified these areas into high and medium priority based on proximity to known knotweed sources. A total of 1311 acres of off-road habitat was surveyed for knotweed in 2013 (Figure 1). We found several more large patches of knotweed, totaling 2.15 acres, all of which were treated for the first time in 2013. No additional off-road surveys were conducted in 2014, due to staff shortages. In 2014 we did conduct a comprehensive survey of 338 miles of road (331.5 miles of drivable roads and 6.5 miles of decommissioned roads) and 13 gravel pits (8 active) as part of the Early Detection/Rapid Response protocol used by the Major Watersheds Invasive Species Program. Only a single new knotweed plant (along an active road) was found during these 2014 road surveys.



**Figure 1.** Off-road areas of high and medium priority to survey for knotweed, plus areas surveyed 2010 – 2013. No additional off-road surveys were conducted in 2014.

## TREATMENT LOGISTICS

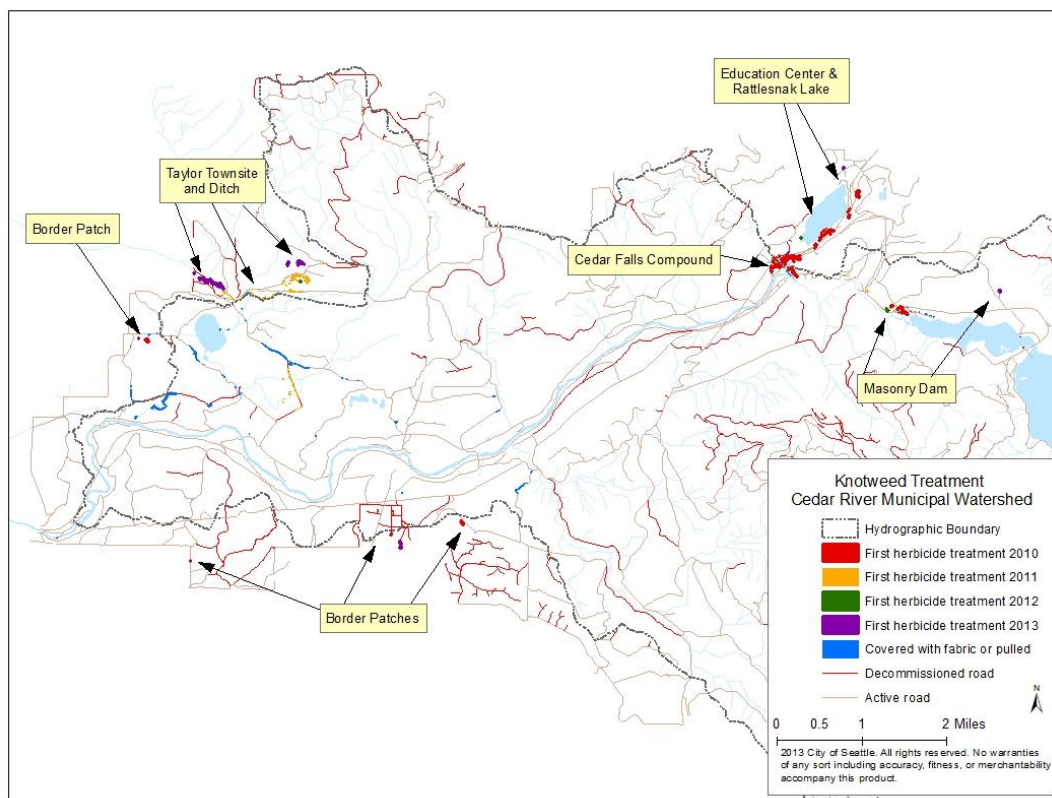
We used the same application method and herbicide concentration as in 2010 – 2013, i.e., a targeted backpack foliar spray of 1% Imazapyr mixed with a 1% modified vegetable oil surfactant and a non-toxic blue dye in water. The same safety procedures were followed, with certified herbicide applicators on site and doing all the mixing of the tank solutions. No spills, injuries, or any adverse effects were incurred by SPU staff or the contract crew members.



conducting the applications. We did the treatment in late August, which is typically the driest time of year.

### AREA TREATED WITH HERBICIDE

We re-treated all areas previously treated with herbicide in 2010-2013 (Figure 2). A total of 7.7 acres were treated for the fifth time, 7.9 acres for the fourth time, 0.3 acres for the third time, and 2.1 acres for the second time. Only a single plant was found and treated for the first time (area too small to include). A total of 18 acres of knotweed was treated with herbicide in 2014, of which only 2.2 acres were within the hydrographic boundary of the Cedar River (Table 1).



**Figure 2.** All known knotweed in the Cedar River Municipal Watershed by treatment year

**Table 1.** Number of knotweed-infested acres treated with Imazapyr by site and year

Cedar River Hydrographic Boundary	Site	Number acres	Treatment Year					Total Treatments
			2010	2011	2012	2013	2014	
Inside	Masonry Dam	0.31	X	X	X	X	X	5
		0.08		X	X	X	X	4
		0.19			X	X	X	3
		0.10				X	X	2
	Cedar Falls	1.55	X	X	X	X	X	5
	<b>Total</b>	<b>2.23</b>						
Outside	Cedar Falls	1.71	X	X	X	X	X	5
		0.04		X	X	X	X	4
	Ed Center/ Rattlesnake Lake	3.04	X	X	X	X	X	5
		0.06		X	X	X	X	4
		0.08			X	X	X	3
		0.11				X	X	2
	Border	1.11	X	X	X	X	X	5
		0.02		X	X	X	X	4
		0.31				X	X	2
	Taylor	7.66		X	X	X	X	4
		0.01			X	X	X	3
		1.63				X	X	2
	<b>Total</b>	<b>15.78</b>						

## IMAZAPYR TREATMENT RESULTS

Most of the smaller sites, especially those along the watershed border had very few small stems. However, some of the larger sites that had received four previous treatments still had numerous small to medium knotweed plants scattered throughout the site, including the area near the Education Center, Cedar Falls, and Taylor townsites. We hypothesize that the massive roots of the knotweed plants may have been in a type of shock from the initial treatments, but not dead. Thus they sent up relatively few shoots and leaves to treat in 2013. This would mean small amounts of herbicide would enter the roots, allowing the roots to produce more foliage this year.

Other possibilities include:

- Contractors may have missed significant numbers of small plants in 2013, hidden amongst dense grass and other shrubs.
- Knotweed plants may have sprouted late in the growing season, after the treatment was completed in late August, and thus were not treated in 2013.
- Contractors may have not applied adequate amount of herbicide to the leaves in 2013.

Consequently, in 2014, we monitored the contractors much more closely. We had them move very slowly and deliberately, to try to minimize the potential for missing small plants in the thick understory of grass and other shrubs. We made sure they adequately treated all the leaves of each individual plant. In addition, we re-surveyed the areas around Cedar Falls and the Education Center four to eight weeks after treatment. We found several plants that apparently had either been missed or had just recently sprouted, as they looked extremely healthy, showing

no signs of being treated. We treated these plants at that time, and hopefully will see much a greater reduction in number of plants in these areas in 2015. Although staff did not have time to re-survey all patches of knotweed, if this technique appears to be successful we will use it more widely in 2015.

### **AMOUNT OF IMAZAPYR APPLIED**

As in previous years, we averaged about 15 to 20 ounces of imazapyr per acre on sites receiving a second treatment and about 10 ounces per acre on sites receiving a third treatment. Sites receiving a fourth or fifth treatment in 2014 averaged three to six ounces per acre. Total amount of imazapyr applied in 2014 was 120 ounces spread over 18 acres. Of this, a total of 14.5 ounces was applied inside the hydrographic boundary spread over 2.2 acres. Total amount of herbicide applied has declined each year, from approximately 43 ounces per acre in 2010 and 2011, to an average of 6.7 ounces per acre in 2014 (Table 2). The legal maximum allowable application rate is 96 ounces per acre per year.

**Table 2.** Total amount of Imazapyr applied and application rate by year.

<b>Year</b>	<b>Amount Imazapyr (oz)</b>	<b>Area treated (ac)</b>	<b>Application Rate (oz/ac)</b>
2010	334	7.7	43.4
2011	678	15.6	43.5
2012	241	15.9	15.2
2013	163	18.01	9.1
2014	120	18.01	6.7

### **WATER QUALITY TEST RESULTS**

As in previous years, water samples were taken both before (baseline) and after (post-treatment) the herbicide application. Samples were taken from two locations on the Cedar River (one at the point closest to a knotweed patch = 250 feet away, and the other at the Landsburg water supply intake facility), one location at Rattlesnake Lake, and one location on a small creek running through the Taylor townsite. All water samples were analyzed for Imazapyr at Pacific Agricultural Laboratory (PACLAB) in Portland, Oregon. PACLAB specializes in analysis of all types of pesticides and has an extremely low detection limit for Imazapyr (0.02 ug/L, or 0.02 parts per billion). No Imazapyr was detected in any of the water samples.

### **SITE RESTORATION**

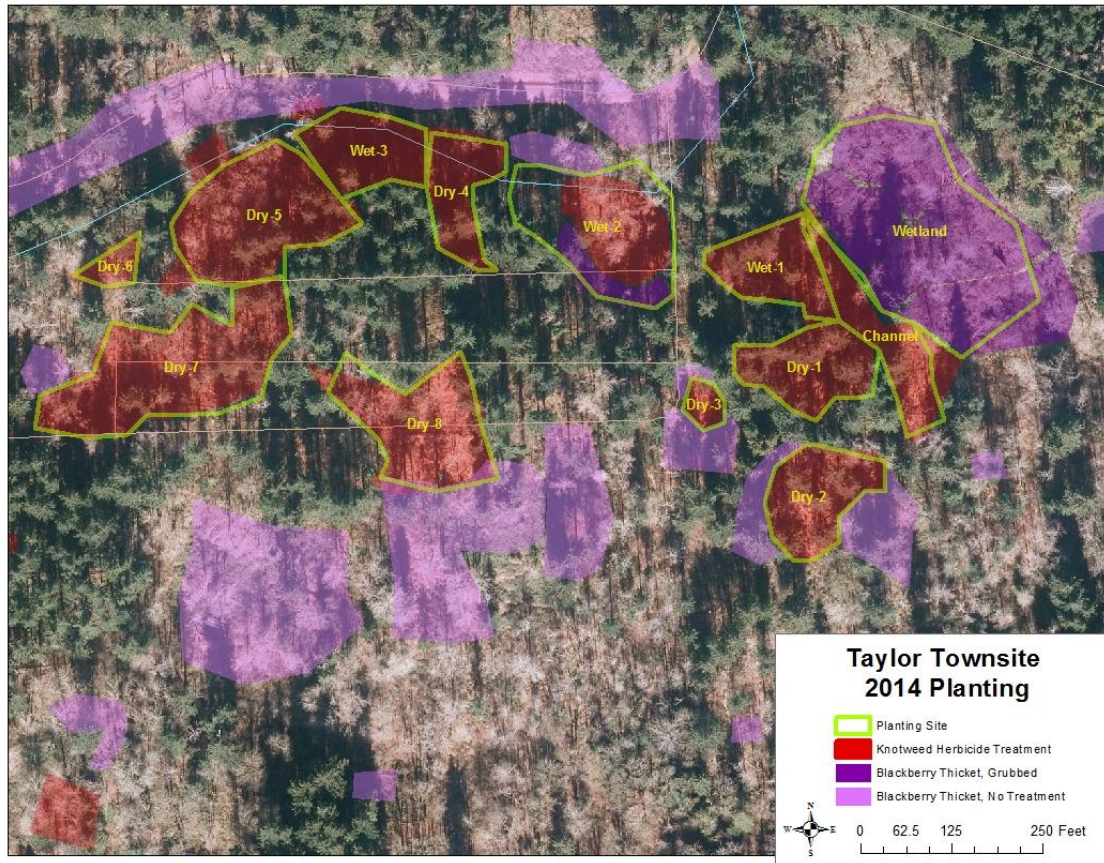
Replanting knotweed treatment sites with native plants following treatment is the most effective method for preventing re-infestation of knotweed and other invasive plants. In 2013 the Friends of the Cedar River Watershed (FCRW), in conjunction with SPU, received a 5-year King Conservation District grant to restore the formerly knotweed-infested area near the Education Center to native trees and shrubs. The grant funds a total of 12 volunteer events and four weeks of Washington Conservation Crew (WCC) time spread over the five years (through 2017). It also funds the purchase of approximately 2800 native plants.

In 2014 volunteers, SPU and FCRW staff, and WCC crews cleared the site of invasive blackberry (*Rubus armeniacus* and *Rubus laciniatus*), ivy (*Hedera helix*), locust (*Robinia pseudoacacia*), foxglove (*Digitalis purpurea*), mullein (*Verbascum thapsus*), and Scots broom (*Cytisus scoparius*) that had invaded the area formerly dominated by knotweed. In late 2013 and early 2014 they planted a total of 180 native trees (six species) and 960 shrubs (20 species). Plus they moved several hundred yards of mulch, surrounding each native planting with mulch to help suppress non-native weeds and provide more growing space for the plantings.

In 2014 at the Taylor townsite WCC and other contract crews cleared the original 6.67 acres of knotweed plus an adjacent 1.5-acre wetland of other invasive species, including invasive blackberries, foxglove, mullein, and non-native thistles. In the spring we had a contract crew plant 1435 native conifer trees that should eventually help provide long-term shade that will help suppress invasive plants in the future. In late fall we supplemented the plantings with 1150 additional trees and 4350 native shrubs, to help restore the area to native habitat and ecological functioning (see table 3 for number planted by species). We split the area into 12 different planting sites, and developed specific prescriptions and species mixes for each site (figure 3).

**Table 3.** Species and number of native trees and shrubs planted at Taylor townsite, 2014

Trees			
Cascara	300	Sitka Spruce	475
Cherry, bitter	300	Western hemlock	220
Cottonwood, black	200	Western redcedar	420
Crabapple, Pacific	300	Western white pine	235
Noble fir	135		
<b>Total trees planted</b>			<b>2,585</b>
Shrubs			
Ceanothus, red-stem	300	Snowberry, western	300
Current, red-flowering	300	Snowbrush	300
Dogwood, red osier	200	Spirea	50
Indian plum	300	Sweet gale	200
Mock-orange	300	Thimbleberry	200
Ninebark, Pacific	300	Twinberry	200
Rose, Nootka	300	Willow, hooker	100
Sedge, Dewey's	200	Willow, Pacific	100
Sedge, slough	200	Willow, Scoulers	100
Serviceberry, western	300	Willow, Sitka	100
<b>Total shrubs planted</b>			<b>4,350</b>



**Figure 3.** Twelve planting sites at the Taylor townsite.

## 2015 PLANS

We plan to monitor all the known knotweed patches and re-treat with Imazapyr as needed in 2015. We anticipate that those sites that have received four or fewer treatments will require similar amounts of herbicide to that seen in the past three years. We will continue to monitor for knotweed patches during our annual road and gravel pit surveys and will conduct off-road surveys in high priority areas as funding and staffing allows. If we find any additional knotweed patches, we treat them in 2015 under the current ordinance. We will re-check knotweed patches four to six weeks after treatment, and, weather-permitting, will treat any new or untreated plants at that time.

Early in 2015 we will plant an additional 735 native trees and shrubs near the Education Center. Our goal is to restore all areas formerly occupied by knotweed to naturally functioning ecosystems dominated by a variety of native trees and shrubs.